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RIVERS AND FLOODS, JUNE, 1914.

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[Dated, Washington, D. C., July 29, 1914.]

THE ANNUAL RISE IN THE COLUMBIA RIVER.

Mr. E. A. Beals, District Forecaster, in charge of the Columbia River district reports:

During the annual rise of the Columbia River this year no flood stages were reached except at Vancouver, Wash., and Portland, Oreg. Portland is on the Willamette River, and the rise in that stream is due to backwater from the Columbia River. Ample warnings were given and no losses occurred in consequence of this flood.

The fact that no great rise would occur this year in the Columbia River was announced in the Snowfall Bulletin for the month of March, 1914, which read as follows: "From the following reports relating to the winter's snowfall in the Columbia River Drainage Area and the amount remaining in the mountains at the end of March, no very high water can be expected in the lower Columbia River this season, unless unusual temperature conditions prevail in May."

The following table shows the stages reached at the various stations along the Columbia River during the rise of 1914:

TABLE 1.—Annual rise of the Columbia River, 1914.

Stations.	Rivers.	Flood stage.	Highest stages, 1914.	
			Stage.	Date
Kamiah, Idaho.....	Clearwater.....	Feet. 12	Feet. 11.9	May 18
Weiser, Idaho.....	Snake.....	14	9.6	May 25
Lewiston, Idaho.....	Clearwater.....	22	13.3	May 25
Riparia, Wash.....	Snake.....	30	13.3	Do.
Bonniers Ferry, Idaho.....	Kootenai.....	26	23.8	June 6
Newport, Idaho.....	Pend Oreille.....	16	13.1	May 31
Northport, Wash.....	Columbia.....	40	23.9	June 21
Wenatchee, Wash.....	do.....	40	32.9	Do.
Kennewick, Wash.....	do.....	25	14.7	May 27
Umatilla, Oreg.....	do.....	25	18.3	May 26
The Dalles, Oreg.....	do.....	40	29.6	May 27
Cascade Locks, Oreg.....	do.....	46	22.7	Do.
Vancouver, Wash.....	do.....	15	17.2	May 28
Portland, Oreg.....	do.....	15	16.8	May 29

The Columbia and the Colorado are preeminently the two rivers in the United States which have a marked rise each year due to melting snow. The volume of water that passed down the Colorado this year was somewhat more than the usual amount, as may be seen from the report of District Forecaster Brandenburg, which follows:

COLORADO RIVER.

Remarkably high stages prevailed in the Colorado River during June. In the streams forming the Colorado the stages, as a rule, were not quite so high as occurred during June, 1909, following a winter of exceptionally heavy snowfall, but at one station on the trunk stream, Topock, near Needles, the highest stage of record, 22.6 feet, occurred. At Yuma, near the mouth, however, the highest stage, 29 feet, was 1.7 feet lower than occurred in 1909.

The highest stages of the season occurred at the beginning of the month in the Grand River and its tributaries, in the upper Gunnison and the San Juan. By the 4th a steady fall was under way, which lasted until the 10th. The stages reached during the rise that followed were

generally about 1 foot below those of the early part of the month. A steady decline set in at the beginning of the third decade. In the Green River the season's crest occurred on the 5th and 9th; from the 10th to the 14th the fall was marked, but throughout the latter half of the month the decline was relatively slight.

In the trunk stream at Topock the highest stage was reached on the 9th; a fall of 11 feet occurred during the next 7 days. At Yuma the highest stage occurred on the 14th and 15th.

Timely warnings, in some cases 8 to 10 days in advance, were sent to localities likely to be injured. Great damage was prevented by the protective measures taken.

ARKANSAS RIVER.

The average discharge of the Arkansas was the greatest for June in the last five years. At Salida the highest stage was slightly lower than in 1912, but at Pueblo and Fort Lyon the stages reached were the highest in years. No material damage resulted from high water.

THE RIO GRANDE RIVER.

In the Rio Grande River the discharge was close to the average, while the highest stages reached were lower than usual.—F. H. Brandenburg, District Forecaster.

RIVERS IN TEXAS.

On June 1 most of the streams of the district were still above flood stage in their lower portions from the heavy rains of May, but were falling rapidly, and, as a rule, were at low-water mark by June 29 or 30. The fall in the Colorado was interrupted by a sharp, though not serious, rise which moved downstream from Ballinger on the 16th and reached Columbus on the 21st, flooding some of the lowlands in that section and at points below. The Brazos

TABLE 2.—Maximum stages of Texas rivers during June, 1914.

Stations and rivers.	Highest.	Date.
<i>Rio Grande:</i>	<i>Feet.</i>	
Eagle Pass.....	12.9	20
Laredo.....	10.0	21
Rio Grande.....	14.3	22
Mission.....	20.4	1
<i>Guadalupe:</i>		
Gonzales.....	17.3	2
Victoria.....	23.1	1
<i>Colorado:</i>		
Ballinger.....	8.0	16
Marble Falls.....	15.5	19
Austin.....	16.5	20
Columbus.....	33.2	2
<i>Brazos:</i>		
Brazos.....	8.8	1
Kopperl.....	10.6	1
Waco.....	18.7	1
Valley Junction.....	39.0	1
Hempstead.....	40.4	4
Booth.....	40.6	7
<i>Trinity:</i>		
Bridgeport.....	4.8	1
Dallas.....	32.2	1
Long Lake.....	40.0	5
Riverside.....	25.2	12*
Liberty.....	27.7	1*
<i>Neches:</i>		
Rockland.....	21.1	1*
Beaumont.....	9.8	1*
<i>Sabine:</i>		
Logansport, La.....	22.9	1
Merryville, La.....	17.6	1
Orange.....	5.2	1

*Also on subsequent dates.

rise reached Hempstead on the 4th and Booth on the 7th. The Trinity was flooded in its upper portion from June 1 to 6, and in its lower portion from June 1 to 10. No damage was reported from the high water in June, but additional damage reported from the May freshets was: Guadalupe Valley, \$21,000; Trinity Valley, \$52,000; and railroads, \$77,000.

Table 2 shows the highest stages recorded at the various river stations during the month.—*B. Bunnemeyer, Section Director.*

DUBUQUE RIVER DISTRICT.

A moderate June flood in the Wisconsin River below Wausau, Wis., and in the Mississippi River from Dubuque, Iowa, to La Crosse, Wis., occurred during the first half of the month as the result of very heavy rains in a portion of northern Wisconsin on June 3-4.

The rainfall within 24 hours, beginning at about 5 a. m. of the 3d and ending about 4 a. m. of the 4th, was 6.08 inches at Medford, Wis. It was probably heavier at Knowlton, but, unfortunately, the rain gage was blown over by the storm and an accurate measurement of rainfall was not obtained. The rainfall within 24 hours was 2.92 inches at Merrill, Wis.; 2.64 inches at Wausau, Wis.; 2.48 inches at Antigo, Wis.; 3 inches at Grand Rapids, Wis. The rainfall on June 3-4 was 3.55 inches at Marshfield, Wis., and 3.43 inches at Stevens Point, probably within a period of 24 hours.

There was no important rise at and above Wausau, Wis. The stage of water at 5 p. m. of June 3 at Knowlton, Wis., was 2.7 feet. The river began to rise rapidly during the night of the 3d-4th, reaching a stage of 5.8 feet at 5 a. m. of the 4th; 12.2 feet at 5 p. m. of the 4th; and a maximum stage of 16.8 feet at 8.45 a. m. on the 5th. The greatest rise in 24 hours was about 10 feet. The only important damage on the Wisconsin River occurred at Knowlton, and is estimated as follows: Four thousand dollars to bridges; \$500 to highways; \$3,000 to growing crops on lowlands; \$200 from suspension of business; total, \$7,700.

At Grand Rapids, Wis., the river rose from 3.3 feet at 7 a. m. of the 4th to a maximum of 12 feet soon after midnight of the 6th-7th. At this place numerous cellars and basements of business houses were flooded, but the goods were removed therefrom, as merchants had sufficient warning of the flood. The main loss was about \$500, due to suspension of business.

There was no loss of much importance below Grand Rapids, Wis., except to wild hay, since live stock and other property was removed from lowlands and islands as the result of warnings issued a number of days in advance of the flood crest. Hundreds of acres of wild hay, growing on lowlands, was spoiled or damaged. The postmaster at Avoca, Wis., states: "One thousand tons of wild hay, valued at \$4 per ton, was spoiled."

HIGH WATER IN THE MISSISSIPPI RIVER.

High water in the Mississippi was due chiefly to floods on the Wisconsin and Black Rivers. The water at Lansing, Iowa, rose 3.2 feet in 5 days, reaching a stage of 10.2 feet on the 13th. At Prairie du Chien it rose 5.2 feet in 7 days, reaching 12.3 feet on the 16th; at Dubuque it rose 5.4 feet in 7 days, reaching 13.4 feet on the 18th.

The chief damage was to crops on lowlands and islands, practically all of which were covered with water from 1 foot to 3 feet. The exact loss is difficult to determine, but probably 1,500 acres or more of growing corn and perhaps 200 acres of growing miscellaneous crops between Dubuque and La Crosse were inundated; value about \$50,000.

The total loss for the Dubuque district, including the Mississippi and Wisconsin Rivers, may be summarized as follows: Loss to bridges, highways, etc., \$6,500; loss of prospective crops, \$60,000; loss of live stock, \$200; loss due to suspension of business, \$8,000; total, about \$75,000.

Warnings were issued a week to 10 days in advance of the flood crest, and a small acreage was saved by temporary dikes. In this connection the following extract from a letter from Mr. W. S. Bickel, of the Bickel Hydro-Electric Construction Co., Cedar Rapids, Iowa, is of interest:

At the time of the flood I was working along the bottom lands in the upper Mississippi Valley. The river stages were forecasted accurately, and in case the owners of land had been familiar with the elevation of their bottom lands, they might have saved large areas from inundation by building temporary dikes, not over 2 feet high. Several fields which came under my observation were covered just enough to drown the corn.

Much live stock was removed from lowlands and islands in time to prevent loss. A large quantity of wood and other property was also removed. The money value of the property saved by warnings in the Dubuque River district is estimated to be about \$25,000.—*J. H. Spencer, Local Forecaster.*

FLOODS IN THE WICHITA RIVER DISTRICT.

The Arkansas River was high generally throughout the Wichita River district between June 16 and 25, 1914, and exceeded flood stage at points from Dodge City to Ellinwood, Kans. The river at Dodge City exceeded its flood stage of 5 feet on the 17th, reaching a crest stage of 5.8 feet at 4:20 p. m. on that date, and receded below flood stage by 8 a. m. on the 18th. The river overflowed its banks at Kinsley on the 19th, reaching a crest stage of about 6 feet on that date, and receded below flood stage on the 21st. The river overflowed its banks in the vicinity of Ellinwood, on the 19th, reaching a crest stage of 6.3 feet on the same day and receding below flood stage on the 20th. The flood stages for the last two points are not known with definiteness, but are probably about 5 feet at Kinsley and about 6 feet at Ellinwood. Reports indicate that the river, though high, was confined within its banks at points below Ellinwood. The high water reached Wichita on the 20th, with a crest stage of +1.6 feet at 7 p. m. The river receded to a stage of 0.0 foot at 7 a. m. on the 25th. The crest at Wichita was probably about 6.6 feet above the average stage of the river during the past winter.—*S. P. Petersen, Observer.*

RIVERS ELSEWHERE.

During the month flood stages were slightly exceeded in the rivers of central and northern California, in the James River in South Dakota, the St. Croix River in Minnesota, the Yellowstone River in Montana, and the Grand River in Missouri, but no damages were reported.